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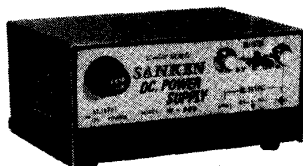
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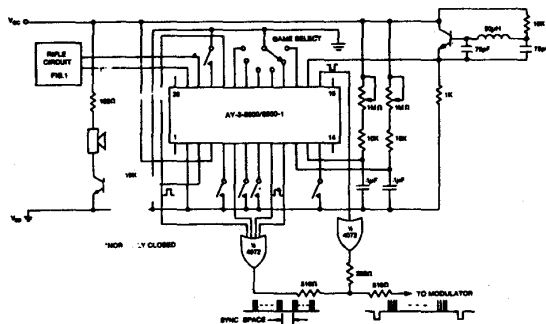
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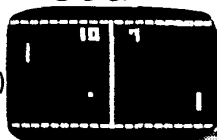


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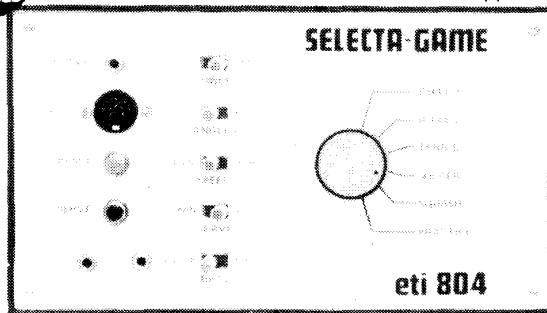
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SELECTA- GAME

**with on-screen scoring
and sound effects**

- * **tennis**
- * **soccer**
- * **squash**
- * **practice**
- * **optional rifle**

This low-cost yet sophisticated TV game contains just one main IC plus a handful of other components yet out-performs virtually all other units currently on the market.

IT IS ABOUT A YEAR NOW SINCE TV games first appeared in Australia. Initially these units retailed for around a hundred dollars and had fairly limited capabilities. Many of our readers requested a TV game project but our investigation showed that 20 to 30 CMOS ICs would be required. As the circuit is quite complex we felt that the chances of a hobbyist building such a unit without problems were small, and any problems encountered would have been likely to be beyond solution with the equipment and knowledge available to the average constructor. We therefore decided not to do the project until single-chip TV game ICs became available. We knew that these chips were being developed and that they would make the project much simpler from the constructional point of view.

This project is based on such a single-chip device type AY-3-8500 from the General Instrument Corporation. The chip offers a choice of six games together with on-screen scoring and sound effects. The games are tennis, soccer, squash, practice and two rifle games. The rifle games require a 'rifle' which has additional circuitry built into it. If there is sufficient demand we will describe the construction of such a rifle at a later date.

Some additional circuitry, including two extra ICs, is required to build the game but the complexity of the complete circuit is still greatly reduced by the use of this particular IC. In

addition, the chip, although expensive, does allow the cost of the unit to be reduced considerably even though its performance is superior to many other games on the market.

Construction

The TV game employs some VHF circuitry which demands correct lay out if proper operation is to be obtained. For this reason the game should only be built onto the printed-circuit board specified.

Commence construction by installing the seven tinned-copper wire links and then the low-height components (resistors, diodes, etc). Next install the capacitors and the transistors. ICs 2 and 3 are CMOS devices and should only be removed from their protective packing when you are ready to install them. Handle them as little as possible and when inserted solder the power supply pins (7 and 14) first. The main IC is expensive and it is therefore recommended (but not essential) that a 28-pin IC socket be used to mount it.

The coils L2 and L3 should now be constructed as detailed in Table 1 and then soldered into position making sure that L2 is oriented correctly.

The rotary switch may now be mounted in the following manner: First solder 25 mm lengths of tinned-copper to each of the switch pins (14 in all). Now orientate the switch correctly and feed the wires through the respective holes in the printed-circuit board, press

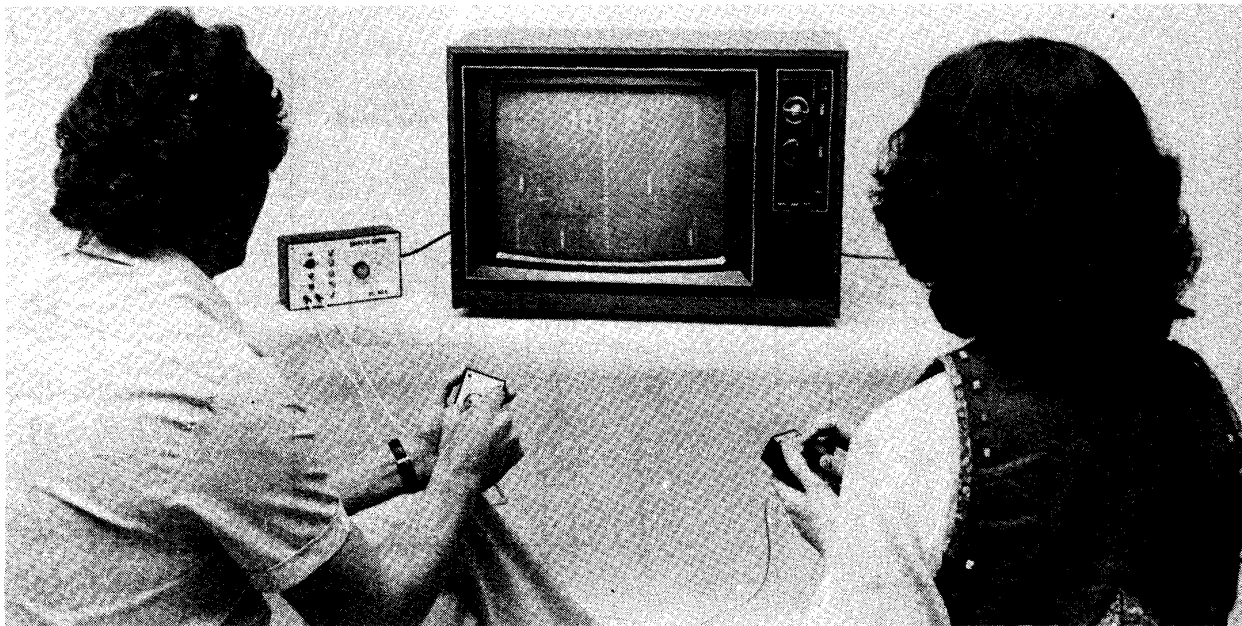
the switch down onto the board and solder all the wires to the tracks of the board.

Now prepare the push buttons, the 5-pin DIN socket and the phono socket by soldering 40 mm lengths of tinned-copper to each of the terminals. Feed the wires through the respective holes in the printed-circuit board but do not solder just yet.

The slide switches should also be prepared in the following manner: Cut 60 mm lengths of 20 gauge BS tinned-copper wire (largest gauge that will fit through the switch holes) and thread them through the holes in the switch pins so that pairs of poles are linked together. Centre the wires in the lugs and then solder them to the lugs. Now bend the wires down on either side and insert them in the holes provided in the printed-circuit board but do not solder at this stage.

Fit the front panel to the rotary switch (use a spacer washer) making sure that the board is square to the front panel and that there is enough clearance for the RF coil and the shield which have yet to be fitted. Attach the phono socket, the DIN socket and the push buttons to the front panel and then solder their leads to the board. Push the slide switches up against the front panel, line the switches up with the openings in the front panel and, making sure that the switch doesn't move, solder the leads to the board.

Now remove the front panel and



fit the 75-ohm output coax and the coax for the bats to the printed-circuit board. Feed the bat cables through rubber grommets in the front panel after first tying knots in them to prevent them being pulled through accidentally. Alternatively 3.5 mm jacks may be installed on the front panel for the bat outputs and the cables fitted with plugs so that they can be unplugged when the game is not being used.

Add the battery leads and connect the speaker by means of 150-mm long wires. Check all wiring and solder joints before fitting the main IC to its socket.

Before the shields for the RF stage

are fitted the unit should be connected to a TV set and aligned and checked as detailed in the alignment section.

After alignment is satisfactorily completed fit the component-side shield using four short lengths of tinned-copper wire and then fit the copper-side shield by simply soldering it to the copper earth plane in four or five places. Make sure that the shields do not touch any other tracks, leads or components which would cause a short.

The alignment of the unit may now be peaked up if required. The front panel is normally at +7.5V due to the connections to the phono sockets and

the shield is at 0V. Some plastic insulation tape should be used over the top of the shield or on the front panel to prevent shorting. Now fit the front panel and mount the assembly in the box. The batteries and speaker should be fitted into the bottom of the box under the printed-circuit board. Holes should be drilled in the box under the speaker to act as a grill to let out the sound from the speaker.

We initially used four "C" size batteries for power as the unit will work from about 5 to 8 volts. However to increase battery life 5 cells of either "C" or "AA" size should preferably be used.

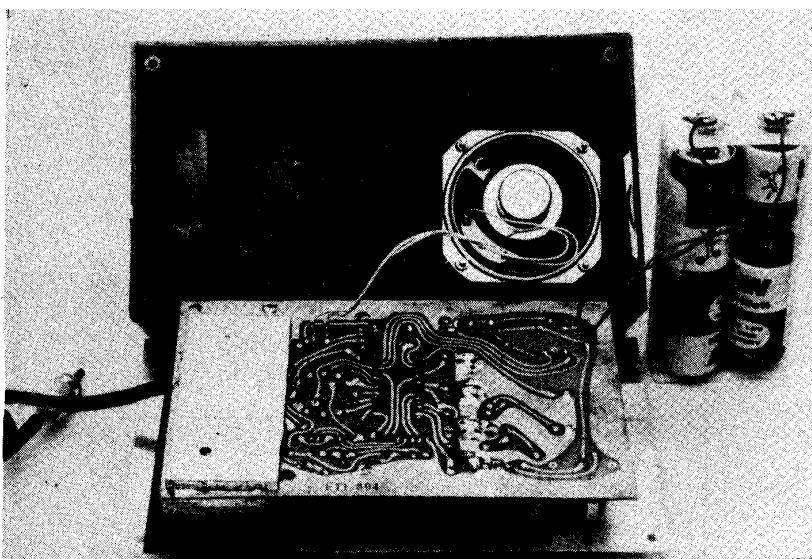
If an external power unit is used either 6 or 7.5 volts dc will operate the unit and the 3.5 mm phone jack used should be used with the +Ve lead on the common terminal.

Alignment

Switch the TV set to channel 6 (5 or 7 could alternatively be used if channel 6 is used in your area), connect the TV game to the antenna input of the set and switch both units on.

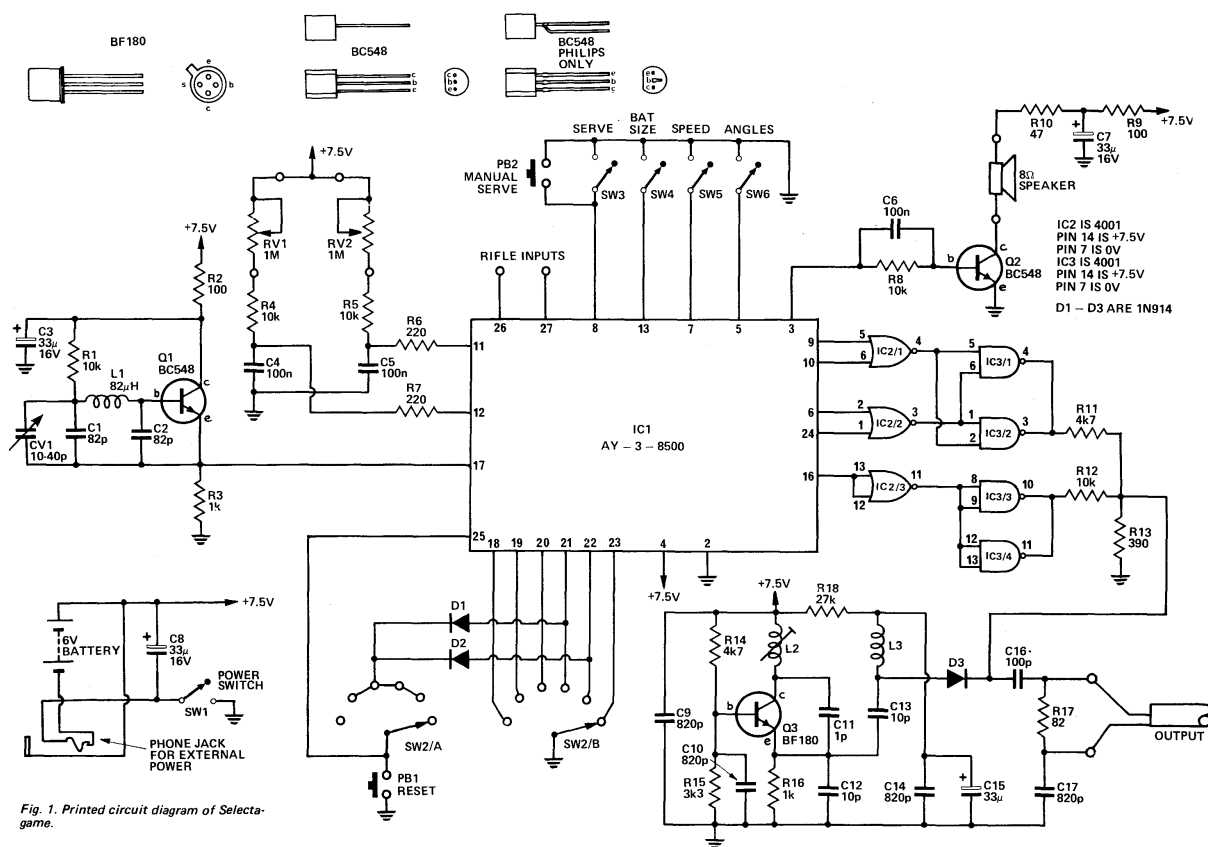
Press the reset button on the game and tune coil L2 until the set appears to be receiving the signal. (At this time the picture may appear to be just a series of dots). Adjust the trimmer capacitor CV1 until the picture locks. Then it may be necessary to readjust L2 for the best picture.

When performing these adjustments it is best to use non-metallic tools so that the tuning point does not alter when the tool is removed.



SELECTA-GAME

ELECTRONICS TODAY INTERNATIONAL - NOVEMBER 1976



How It Works — ETI 804.

Unfortunately the manufacturers don't give much information on how the main IC works — we are only told how to use it. The chip is obviously a digital IC (because there are two ball speeds, the rebound angles are defined and there is no provision for variable speed or bounce).

A 2 MHz oscillator is required for the chip to derive the synchronising pulses required for line and frame synchronisation of the TV set. This oscillator is provided by Q1 and its associated components with CV1 providing calibration.

The bats are simply one megohm potentiometers connected as variable resistors which effectively vary the charging time of capacitors C4 and C5. The capacitors C4 and C5 are discharged by the chip at each frame sync pulse and the time taken to charge again (as set by the bat pot setting) determines the vertical position of the bats on the screen. The bat size, ball speed, deflection angles and serve are simply selected by connecting the appropriate pin of the IC to '0' volts.

Outputs from the chip are left and

right bat, sync, ball, score and sound — all on separate pins. The bats, ball and score outputs are combined by IC2/1,2 and IC3/1,2 to produce a composite video signal. The sync pulse is buffered by IC2/3 and IC3/3,4. The sync and information pulses are then added by R11, 12 and 13. The sound output is buffered by Q2 to provide the power necessary to drive the speaker.

So that the game may be fed into the antenna terminals of a TV receiver the video signal must be modulated onto an RF oscillator tuned to the

desired channel (176 MHz for channel 6). Transistor Q3 and its associated components form the required oscillator. The oscillator is then modulated with the composite video by means of the diode modulator D3.

The oscillator and the modulator are screened by means of shields to prevent the RF from causing interference to other TV sets (and to prevent other TV sets from interfering with the game). These shields also minimise detuning effects when the hand is brought close to the oscillator.

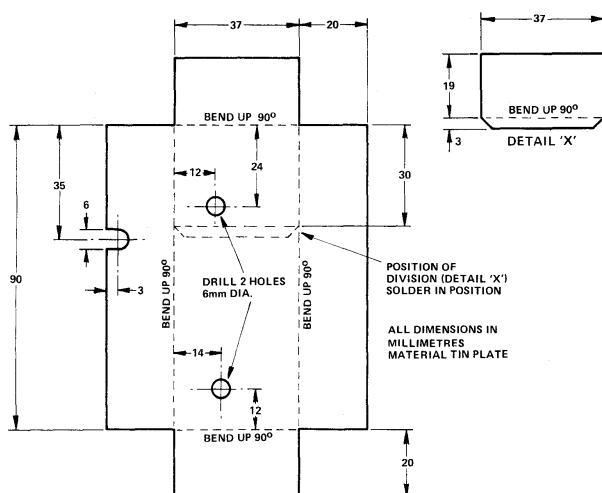


Fig. 2. Dimensions of shield on component side.

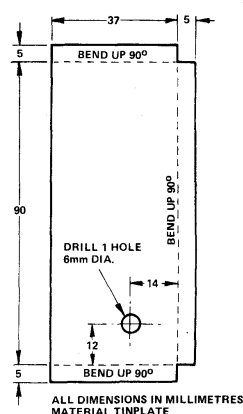
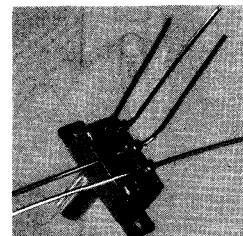
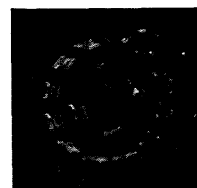


Fig. 3. Dimensions of shield on copper side.



Photographs showing wires attached to switches before installation.

Project 804

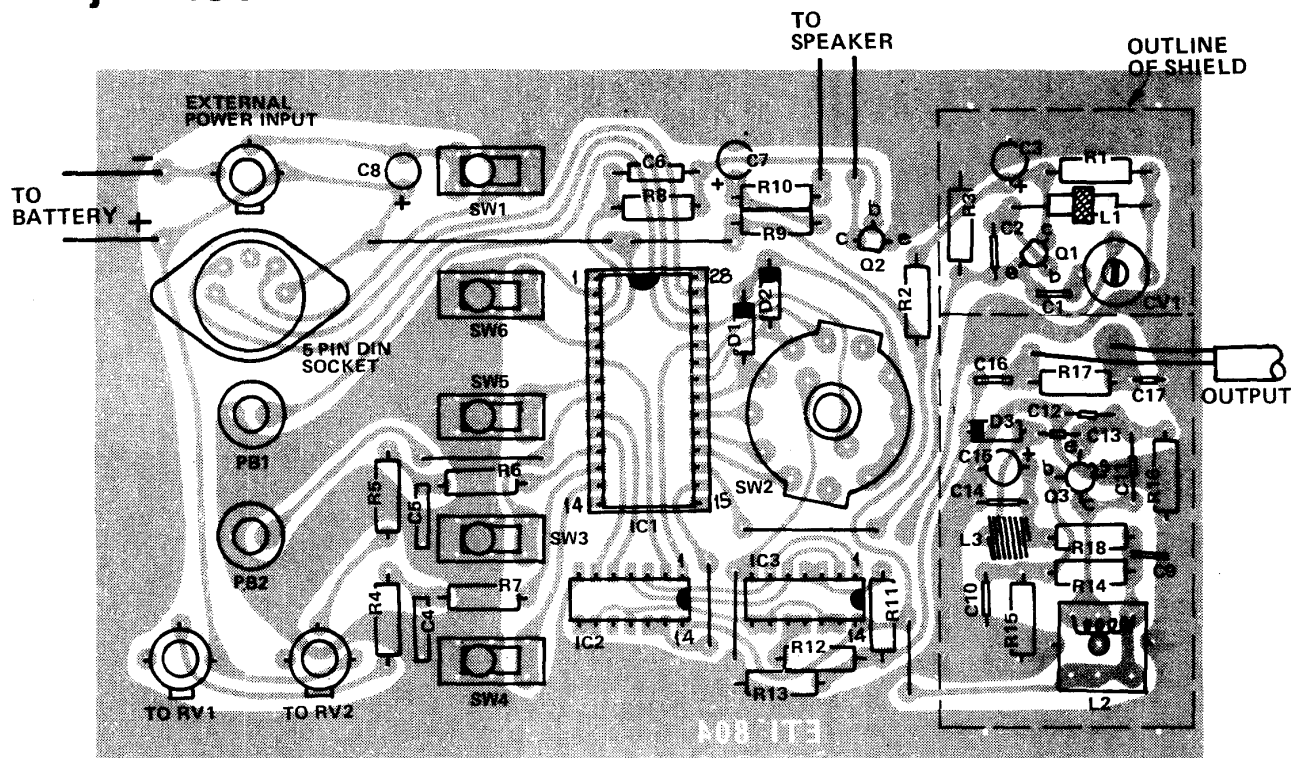


Fig. 4 Component overlay of Selecta-game.

PARTS LIST ETI 804

Resistors all 1/4w 5%

R1	10 k
R2	100
R3	1 k
R4,5	10 k
R6,7	220
R8	10 k
R9	100
R10	47
R11	4 k 7
R12	10 k
R13	390
R14	4 k 7
R15	3 k 3
R16	1 k
R17	82
R18	27k

Potentiometers

RV1,2	1M lin rotary
-------	---------------

Capacitors

C1,2	82 p ceramic
C3	33 μ 16 v electro
C4,5,6	100 n polyester
C7,8	33 μ 16 v electro
C9,10	820 p ceramic
C11	1p0 ceramic
C12,13	10 p ceramic
C14	820 p ceramic
C15	33 μ 16 v electro
C16	100 p ceramic
C17	820 p ceramic

Variable capacitor

CV1	10-40p
-----	--------

Transistors

Q1,2	BC548 or similar
Q3	BF180

Diodes

D1-D3	1N914
-------	-------

Integrated Circuits

IC1	AY-3-8500
IC2	4001 (CMOS)
IC3	4011 (CMOS)

Inductors

L1	82 μ H RF choke
L2	See table 1
L3	See table 1

Miscellaneous

PC board eti 804
2 pole 6 position switch
Five slide switches
8 ohm speaker
3.5 mm phone socket
5 pin DIN socket
Two miniature push buttons
Three knobs
One large box 196mm x 113mm
Two small boxes 83mm x 54mm
Single "C" size battery holder der
28 pin IC socket

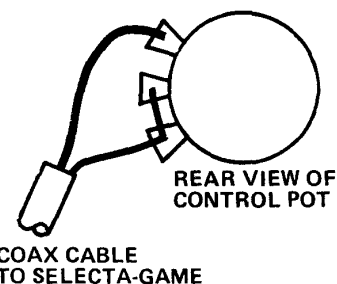


Fig. 5. Diagram showing wiring of control pot.

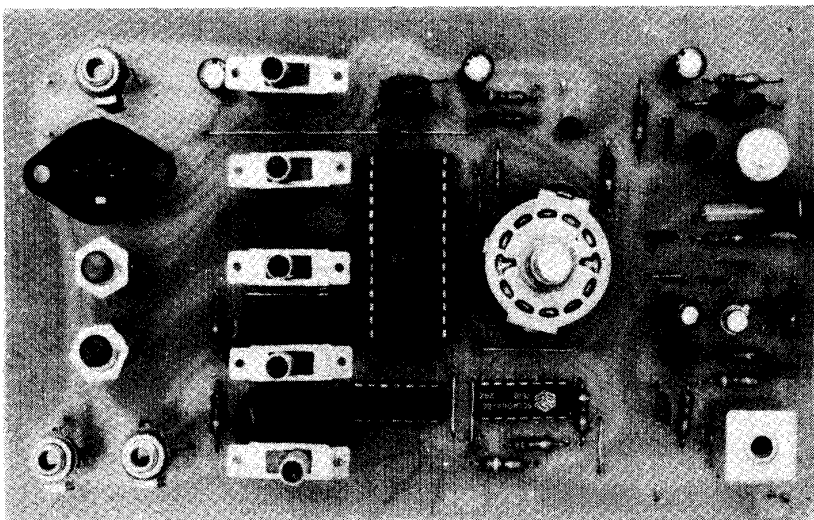
TABLE 1 ETI 804

Winding details of coils L2 & L3

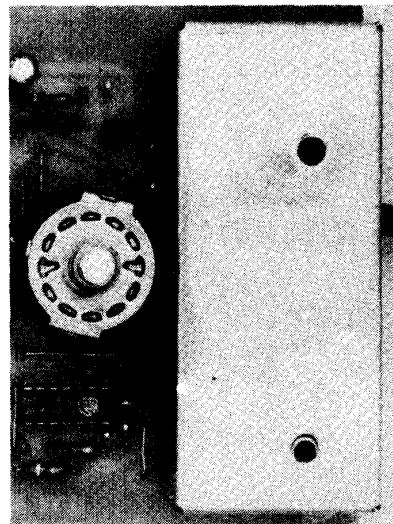
L2	
Former 5mm	Neosid 722/i
6 pin base	Neosid 5027/6 PLB
Can	Neosid 7100
Slug	Neosid 4 x 0.5 x 10 F29

Winding 4 turns close wound 24 B&S

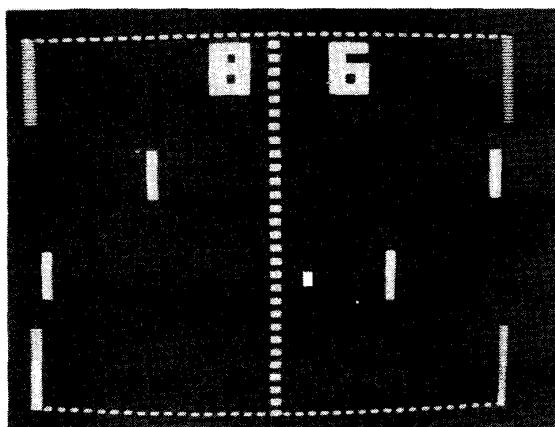
L3
6 turns 24 B&S wire close wound about 5mm diameter, air core. (wind on a former, ie a knitting needle or drill, then remove former)



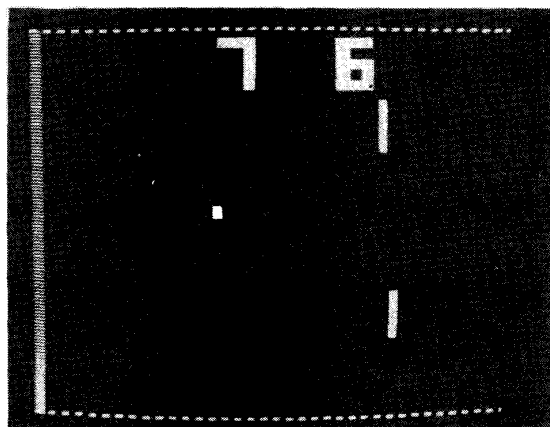
Photograph of completed board less shield.



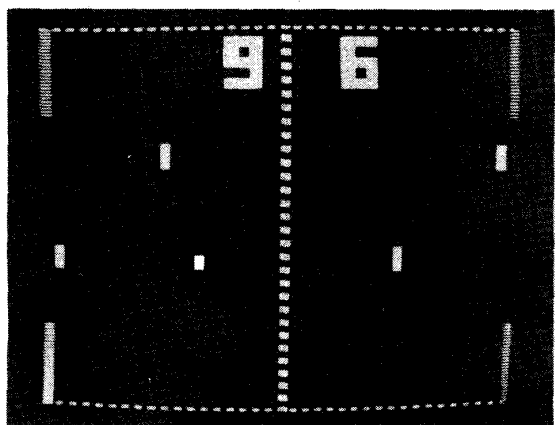
Photograph showing shield fitted. Note two adjustment holes



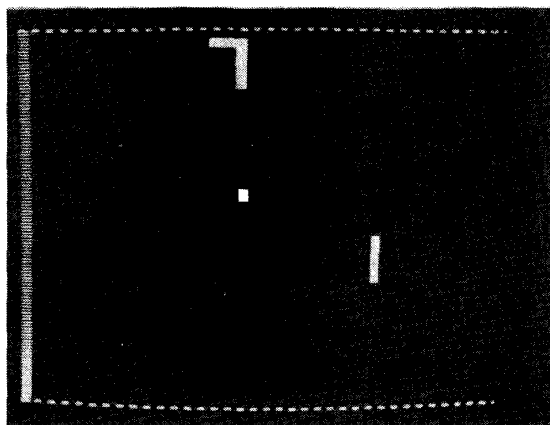
Soccer



Squash



Soccer with small bats



Practice

These photographs show some of the games that can be played.

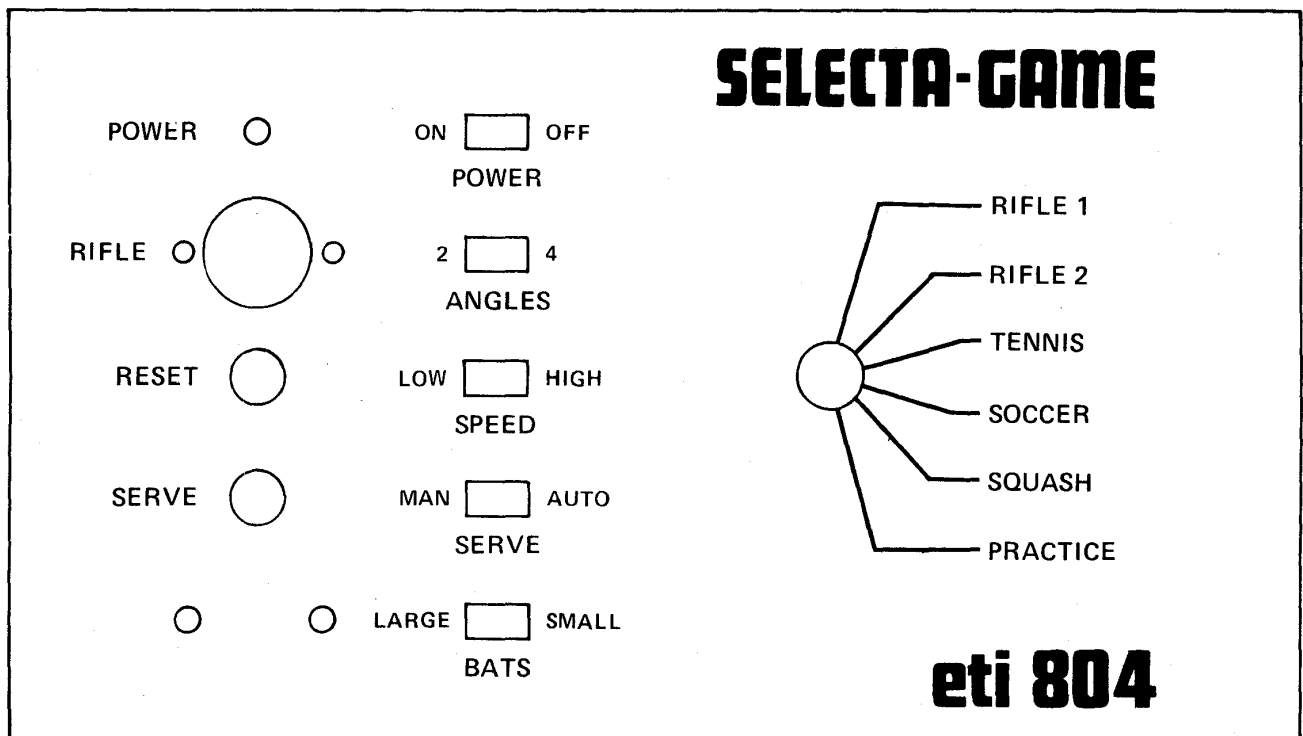


Fig. 6. Front panel layout. Full size 190mm x 107mm.

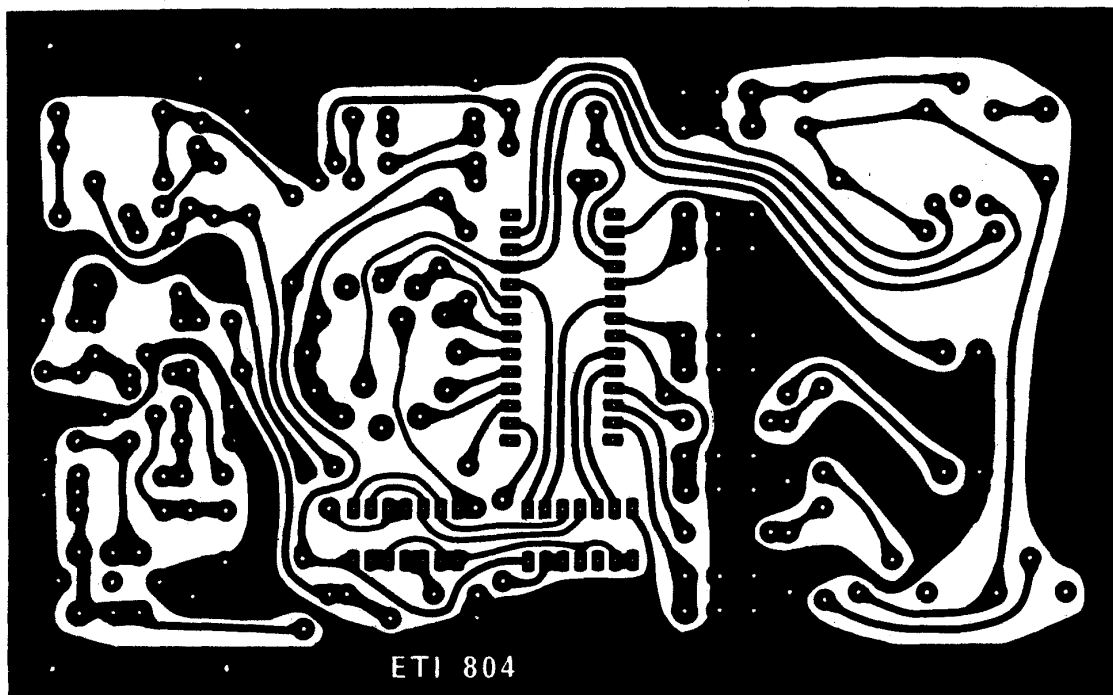


Fig. 7. Printed-circuit layout. Full size 163mm x 102mm.

- 1) Practice:** The ball reflects off the end wall and the side walls — the player has to stop it exiting the screen on the right-hand side. This game is an electronic version of hand-ball or squash with only one player.
- 2) Squash:** This game is like the practice game but now there are two players who take turns in hitting the ball. The bat has no effect on the ball when it's your opponent's turn.
- 3) Soccer:** The ball reflects off all four sides of the pitch, except for the goal mouth. The goalkeeper defends this in

the same way that the bats defend their court in the other games. The player has a second man on the field for soccer — the forward. This man will act like a bat when faced with a ball moving towards his own goal — the ball reflects towards his opponent's goal — but when the ball is moving in the right direction (towards his opponents side) the ball passes through him. However by careful positioning of the forward the ball can be made to deflect towards the goal.


4) Tennis: The game of TV Tennis is widely known and on Selecta-game the only unusual features are those listed in the specification.

Output	Picture: TV signal on channel 6 (can be set up on any other channel). Sound: Three audio tones indicate hit, bounce and score. Reproduced from a loudspeaker in Selecta-Game.
Players' Controls	Each player uses a single rotary control to position his bat/men on the screen. In the practice game one control operates; for tennis, soccer and squash two players each have a control. For the rifle games a special rifle is needed (not described in this article).
Game Selection	Basic Games: 1) Practice 2) Squash 3) Soccer 4) Tennis Other Games (these cannot be played without a special rifle): 5) Rifle—1 6) Rifle—2
Scoring	On-screen scoring up to a maximum of 15 points.
Other Features	Two ball speeds Two bat sizes Two angles ± 20°; or four angles ± 20° & ± 40°. Manual or automatic service

With the 'Angles' switch at '2' the ball moves across the screen at $\pm 20^\circ$ from the horizontal. When hitting the sides and walls of the court the laws of reflection are obeyed. When the ball hits the bat this isn't always the case: a ball hitting the top half of the bat will leave with an upward trajectory, and a ball hitting the bottom half of the bat will bounce downwards. This effect can be utilised by the skilful player —

when the soccer forward is used to change the direction of the ball as it approaches the goal it usually beats the goalkeeper.

With the 'angles' switch at '4' the game becomes even more exciting. Now the bat has to be divided into quarters: starting from the top and working down the angles of the emerging ball are $+40^\circ$, $+20^\circ$, -20° , -40° . And if you can cope with that try switching to small bats and high speed ball! ●



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(See June '76 ETI).

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			for \$35.		
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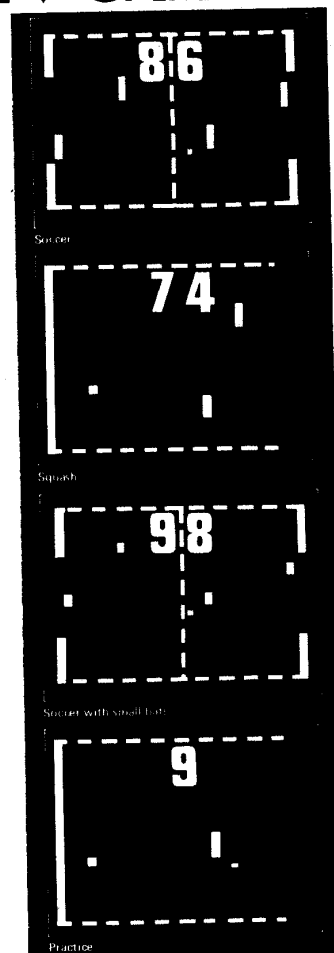
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